

REMARKS

Amendments

Claims 1, 21, 25, 45, 46, 48, 49, 51 and 52 have been amended to specify that the claimed selective oxidation process oxidizes the various sulfur compounds in the hydrocarbonaceous feedstock to sulfur dioxide with no or minimal oxidation of the non-sulfur containing hydrocarbonaceous compounds. These amendments are supported by the disclosure in paragraph [0010] of Applicants' published application.

Claims 46 and 49 have additionally been amended to recite that the gaseous feed mixture has an oxygen-to-carbon ratio of below 0.15. Support for these amendments is found in paragraph [0012] of Applicants' published application.

The spelling of "hydrocarbonaceous" has been corrected in claim 25, and commas have been added after "cerium" in claims 45 and 48.

Claim Rejections – 35 USC § 103

I. The Rejection of claims 1-2, 9, 11-21, and 24 under 35 U.S.C. §103(a) as Being Unpatentable over Frame (US 3,978,137) in View of Yoo (US 3,945,914), Mahadev (WO 92/20621), and Mackrodt (US 5,137,682), is Respectfully Traversed

I. (a) The Presently Claimed Invention

The presently claimed process relates to the catalytic selective oxidation of sulfur compounds, including difficult to treat sulfur compounds such as thiophenes, contained in a hydrocarbonaceous feedstock. The "selective oxidation of sulfur compounds" is defined in paragraph [0010] of Appellants' published application to mean the oxidation of sulfur compounds, with no or minimal oxidation of the non-sulfur containing hydrocarbonaceous compounds. This important feature of the present process has now been added by amendment to the claims. Applicants have discovered that the selective oxidation of sulfur compounds in hydrocarbonaceous feedstocks, with no or minimal oxidation of hydrocarbons, can be accomplished by contacting a gaseous feed mixture of the hydrocarbonaceous feedstock and a molecular-oxygen containing gas in the presence of a particular defined catalyst under particular defined conditions, including a temperature of at the most 500 °C and a oxygen-to-carbon ratio in the feed mixture of below 0.15.

The catalyst employed in the process of the invention is defined in the claims to consist essentially of a catalytically active group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof at a concentration in the range of from 0.02 to 10% by weight, based on the total weight of the catalyst, supported on a catalyst carrier comprising zirconia that is stabilized or partially stabilized with yttria.

The specific limitations being relied to distinguish over the references employed in the various rejections include: A process for the selective oxidation of a sulfur compound contained in a hydrocarbonaceous feedstock to sulfur dioxide, with no or minimal oxidation of the non-sulfur containing hydrocarbonaceous compounds, using a catalyst which consists essentially of a catalytically active group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof, at a concentration in the range of from 0.02 to 10% by weight, wherein a feed mixture of the hydrocarbonaceous feedstock and a molecular-oxygen containing gas is contacted with the catalyst at a temperature of at the most 500 °C, and the feed mixture has an oxygen-to-carbon ratio below 0.15.

As discussed below, none of the cited references alone or in combination, teach or reasonably suggest the above-mentioned combination of limitations, which are necessary to achieving the desired selective oxidation of sulfur compounds in a hydrocarbonaceous feedstock to sulfur dioxide, without oxidizing the non-sulfur containing hydrocarbonaceous compounds.

I. (b) The Sulfur Compound Oxidation Process Disclosed in the Primary Reference Employs a Different Catalyst System than the Catalyst Employed in the Selective Oxidation Process Recited in the Present Claims

The primary reference, Frame (US 3,978,137) (hereafter “Frame”), discloses a process for the oxidation of sulfur-containing compounds which comprises treatment of the sulfur-containing compounds with an oxygen-containing gas in a medium possessing a pH in the range of 8 to a pH of 14 in the presence of a two component catalyst system comprising a Group VIIB metal phthalocyanine and a Group VIII metal phthalocyanine at oxidation conditions, and recovering the resultant oxidized sulfur-containing compound (col. 2, lines 32-41).

In column 3, lines 51-54, it is stated that: “In the pure essence of this invention the catalyst system for the oxidation of sulfur-containing compounds comprises a Group VIIB metal phthalocyanine and a Group VIII metal phthalocyanine two-component system.” (emphasis added). Frame goes on to teach that the catalyst system may be present in a range of from about 6

parts per Group VIIB metal phthalocyanine to about 1 part Group VIIB metal phthalocyanine per part Group VIII metal phthalocyanine.” (col. 3, lines 55-59). This indicates that a major proportion the two-component catalyst system of Frame must be a Group VIIB metal phthalocyanine, i.e., from 6 to 1 parts Group VIIB metal phthalocyanine per part of Group VIII metal phthalocyanine. Expressed in percentages, the proportions would be from 85.7 to 50 % Group VIIB metal phthalocyanine to 14.3 to 50 % Group VIII metal phthalocyanine.

The importance of a Group VIIB metal phthalocyanine being used in conjunction with the Group VIII metal phthalocyanine is also emphasized in col. 4, lines 32-36, of Frame, wherein it is stated: “It should again be noted that the catalyst system comprises a two-component system whereby it is necessary for the Group VIIB metal phthalocyanine and the Group VIII metal phthalocyanine to be present in conjunction with one another.” (emphasis added).

In order to clearly distinguish the catalyst employed in the present process from the two-component Group VIIB metal phthalocyanine and a Group VIII metal phthalocyanine catalyst system disclosed in Frame, Applicants amended the present claims to read “ wherein said catalyst consists essentially of a catalytically active group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof”. The transitional phrase “consisting essentially of” functions to exclude a two component catalyst system such as that disclosed in Frame, which contains a major proportion of a Group VIIB metal phthalocyanine as an essential component. As discussed Sections I.(c) and I.(d), below, the basic and novel characteristics of the presently claimed selective oxidation process are disclosed in the present specification, and would be materially altered if the two component catalyst system disclosed in Frame were utilized in the present process. Therefore, it would be inappropriate (and clear error) for the Examiner to construe the transitional phrase “consisting essentially of” as “comprising” in the present circumstances. Accordingly, it is respectfully requested that the Examiner reconsider his position in this regard.

I. (c) The transitional phrase “Consisting Essentially of” Should Not be Construed as “Comprising” in Rejecting the Present Claims

The Examiner indicates on page 6 of the subject Office action, that for the purposes of searching and applying the prior art, he is treating the transitional phrase “consisting essentially of” as if it is equivalent to the term “comprising” in the absence of a clear indication of the basic

and novel characteristics of the invention. However, Applicants' specification, clearly presents the basic and novel characteristics of the inventive process.

The basic and novel characteristics of the presently claimed process include the use of a catalyst capable of selectively oxidizing sulfur compounds in a hydrocarbonaceous feedstock directly to sulfur dioxide, with no or minimal oxidation of the non-sulfur containing hydrocarbonaceous compounds. The catalyst employed in the claimed selective oxidation process is specified to consist essentially of a catalytically active group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof at a concentration in the range of from 0.02 to 10% by weight, based on the total weight of the catalyst, supported on a catalyst carrier comprising zirconia that is stabilized or partially stabilized with yttria. The selective oxidation of the sulfur compounds in the hydrocarbonaceous feedstock directly to sulfur dioxide can be accomplished using the presently claimed process, without the need to adjust the pH of the contacting medium, or the need to add any additional materials.

Extensive details concerning the catalyst employed in the present inventive process, and concerning a comparative catalyst, are presented in Example 1. See paragraphs [0030] – [0045] of Applicants' published application. As described in Example 1, the inventive catalyst includes a support particle of zirconia that is partially stabilized with yttria (Y-PSZ). The support particles may be painted with a zirconia paint and impregnated with at least one or more of either rhodium, iridium, zirconium, or cerium. Presented in Table 1 is performance data for the inventive catalyst and for the comparison catalyst. The data show that the inventive catalyst provides for a higher H₂S conversion for a given reaction temperature than does the comparison catalyst, and the selectivity is significantly different as well. See paragraph [0045] and Table 1. The specification also suggests that the catalyst provides for a lower reaction temperature for carrying out the oxidation of sulfur compounds, and that at these lower temperatures the oxidation of the sulfur compounds takes preference over the oxidation of hydrocarbons. See paragraph [0019].

Therefore, the Examiner's construction of the transitional phrase "consisting essentially of" as "comprising" is incorrect in that the basic and novel characteristics of the invention are clearly indicated in the specification and clearly distinguishes the presently claimed process from the process of Frame which employs a two-component metal phthalocyanine catalyst system that must be used in a medium having a pH of from 8 to a pH of 14, and only oxidizes sulfur compounds

such as hydrogen sulfide to sulfur and mercaptans to disulfides, instead of oxidizing the sulfur compounds to sulfur dioxide.. (This latter aspect is discussed in greater detail in Section I.(e), below.)

When the “consisting essentially of” transitional phrase is given its proper legal meaning, as required by the present circumstances, claims 1-2, 9, 11-21 are clearly patentable over Frame, alone or in combination with the additional references cited, i.e., Yoo et al (US 3,945,914), Mahadev et al (WO 92/20621) and Mackrodt (US 5,978,137), each which are discussed in the following sections.

I. (d) The Sulfur Compound Oxidation Process Disclosed in the Primary Reference Requires an Additional Condition and an Additional Material Not Required in the Selective Oxidation Process Recited in the Present Claims

The process for the oxidation of sulfur compounds disclosed in Frame is taught to be effected in a medium possessing a pH in the range of from about a pH of 8 to about a pH of 14 (col. 4, lines 66-68). In order to meet this pH requirement, the medium which supplies the pH will comprise an alkaline material such as sodium hydroxide, potassium hydroxide, lithium hydroxide, rubidium hydroxide, cesium hydroxide, barium hydroxide, etc. (col. 4, line 68 to col. 5, line 18). Note that even if the two-component catalyst is dispersed on an inert support, it is still important that the treatment medium possess a pH of from about 8 to about 14 (col. 5, lines 27-35).

As shown by the examples in the Applicants' specification, the present selective oxidation process utilizing the catalyst recited in the present claims, does not require a medium having a pH of from about 8 to about 14, and does not require the addition of an alkaline material.

Applicants recognize that the present claims do not expressly exclude operating at a pH of from 8 to a pH of 14, or exclude adding an alkaline material. However, the fact that Frame's oxidation process requires a medium having pH of from 8 to 14 and requires the addition of an alkaline material, while Applicants' process does not, is believed to be relevant to the issue of obviousness, in that it demonstrates a clear advantage for Applicants' process. Even more importantly, it further demonstrates the significant differences between the respective processes.

In order to modify the process of Frame to arrive at Applicants' selective oxidation process, one skilled in the art would have to change the catalyst system from a two-component system, including a major amount of Group VIIB metal phthalocyanine, to a single component system, contrary to Frame's teaching that the two components must be used in conjunction. In

addition, one skilled in the art would have to modify the severity of the oxidation conditions to produce sulfur dioxide, instead of the sulfur and disulfides oxidations products produced by the process disclosed in Frame. Furthermore, one skilled in the art would have to disregard the clear teachings in Frame that the catalyst system must be used in a medium having a pH of from about 8 to about 14, which is accomplished by adding an alkaline material to the medium. Applicants respectfully submit that making these extensive and unobvious changes, which are contrary to the teachings of the reference, is not within the routine skill and knowledge of one of ordinary skill in the art. Rather it is strong evidence of an invention.

I. (e) The Sulfur Compound Oxidation Process Disclosed in the Primary Reference Does Not Oxidize Sulfur Compounds to Sulfur Dioxide as Required by the Present Claims

Another important distinction between the presently claimed process and the oxidation process in Frame, which is not addressed in the subject Office action, is that the sulfur compounds in Frame are not selectively oxidized to sulfur dioxide, as required by the present claims. Instead, the sulfur compounds in Frame are oxidized to elemental sulfur in the case of hydrogen sulfide, or disulfides in the case of mercaptans. See the disclosure in col. 2, lines 9-24, of Frame wherein it is taught that the utility of the disclosed invention is that sulfur, the resultant oxidation product of hydrogen sulfide, can be used in the chemical industry, while various disulfides, which are separated and recovered subsequent to the oxidation of mercaptan compounds, can be selectively reduced back to mercaptans for use in natural gas for safety purposes.

Thus, the sulfur compound oxidation process in Frame, not only uses a different catalyst system than the catalyst recited in the present claims, it also produces different products (i.e., sulfur and disulfides) instead of the sulfur dioxide produced in Applicants' selective oxidation process. The fact that the sulfur compound(s) in the present process are selectively oxidized to sulfur dioxide is recited as a limitation in each of independent claims.

I. (f) Yoo et al (US 3,945,914)(hereafter "Yoo")

Yoo teaches a two-step process including a first step involving the oxidation of sulfur contained in a hydrocarbon material with an oxidant, optionally, in the presence of a metal-containing catalyst, (col. 2, lines 46-63), followed by contacting the oxidized sulfur-containing hydrocarbon material with a metal-containing compound under certain temperature conditions so

as to form a metal-sulfur-containing compound. (col. 1, lines 50-61; and col. 7, lines 10-30). The preferred catalyst metals for the optional oxidation catalyst are Group IVB, Group VB, and Group VIB metals. (col. 4, lines 7-10). There is no disclosure in Yoo of a catalyst based on a Group VIII noble metal. Therefore, Yoo is even less relevant than Frame in this regard, since Frame at least discloses a two component catalyst system which includes a Group VIII metal phthalocyanine as a minor component.

Yoo does teach that the concentration of oxidant is usually dependent upon the amount of sulfur present in the hydrocarbon material as stated on page 5 of the subject Office action. It is noted that the preferred oxidants employed by Yoo are organic peroxides, organic hydroperoxides, organic peracids and hydrogen peroxide (see col. 3, lines 13 to col. 4, line 6), while a molecular-oxygen containing gas is employed in Applicants' process.

I. (g) Neither Frame nor Yoo Teach or Reasonably Suggest a Gaseous Feed Mixture Having the Oxygen-to-Carbon Ratios Recited in the Present Claims

On page 4 of the subject Office action the Examiner acknowledges that Frame does not explicitly disclose mixing a gaseous hydrocarbonaceous feedstock with an oxygen-containing gas having an oxygen-carbon ratio of below 0.10. As discussed below, the limitations in the claims regarding the oxygen-to-carbon ratios of the gaseous feed mixture to the present process are not taught or reasonably suggested by Frame, Yoo, or any of the other cited references.

In an effort to overcome the deficiency of Frame in not teaching the oxygen-to-carbon ratios recited in the present claims, the Examiner, on page 5 of the subject Office action, takes the position that Yoo teaches a feed mixture having an oxygen-carbon ratio of 0.005 based on certain calculations and assumptions made by the Examiner. While this calculated value is within the limitation recited in the present claims, Applicants respectfully submit that the Examiner's calculated value is not reflective of the overall teachings of Yoo, appears to be based in part on an incorrect assumption, and also appears to involve impermissible hindsight reasoning as discussed below.

The basis for the Examiner's calculation is set forth on page 5 of the subject Office action and reads as follows:

“In addition, Yoo explains that a hydrocarbon feed mixture of oxygen-containing has an oxygen-sulfur ratio of about 0.5 with the sulfur

content of the feed being about 1 wt%. Because hydrocarbons comprise carbon atoms, 99% of the feed would contain carbon atoms.

Thus, the oxygen-carbon ratio would be approximately 0.005 (see Yoo column 1, lines 64-68; and column 2, lines 43-63.”

What Yoo actually discloses in col. 1, lines 64-68, is that, in general, the sulfur content of the hydrocarbon materials may be greater than 1 % by weight. The hydrocarbon material employed in Examples I to III, in col. 9 of Yoo, had a sulfur content of 1.73 wt%. (See col. 9, line 22).

What Yoo actually discloses col. 2, lines 43-63, is that the mole ratio of oxidant to sulfur contained in the hydrocarbon material is from about 0.5 to about 10 atoms of active oxygen per atom of sulfur, preferably from about 1 to about 8 atoms of active oxygen per atom of sulfur, and more preferably from about 1.5 to about 4.0 atoms of active oxygen per atom of sulfur. The ratio of oxidant to sulfur in Examples I to III of Yoo was 3.0 moles tertiary butyl hydroperoxide per mole of sulfur (col. 9, lines 49-51). Yoo did not employ a molecular oxygen-containing gas in any of the Examples. Since Yoo teaches a range of active oxygen atoms to sulfur of 0.5 to 10, and also teaches that the hydrocarbon material generally has a sulfur content greater than 1 wt%, it is unclear why the Examiner chose the specific oxygen to sulfur ratio of 0.5 and a sulfur content of 1 wt% for his calculation.

Applicants are also unclear as to the basis for the statement on page 5 of the subject Office Action that: “Because hydrocarbons comprise carbon atoms, 99% of the feed would contain carbon atoms.” Since hydrocarbonaceous feeds contain hydrogen as well as carbon, and typically contain various amounts sulfur compounds and nitrogen compounds, it is highly unlikely that the carbon atom content of the feed would ever be 99% as assumed by the Examiner. Note, for example, the feed employed in Examples I to III of Yoo contained 85.80 wt% carbon (see col. 9, line 24).

For all these reasons it is submitted that the Examiner’s calculated oxygen-to-carbon ratio is fatally flawed and not based on the actual teachings of Yoo. The fact that the Examiner could not find a disclosure of an oxygen-to-carbon ratio of below 0.15 in any of the cited references, and had to resort to a calculated value based on another ratio (oxygen to sulfur), is itself evidence of the unobviousness of the oxygen-to-carbon ratio limitations in the present claims.

It appears when the Examiner couldn't find a reference which taught or suggested an oxygen-to-carbon ratio of below 0.15, the Examiner took Applicants' own teaching that this limitation was important to achieving selective oxidation, and used this teaching to calculate a hypothetical oxygen-to-carbon using a different ratio (oxygen to sulfur), and values selected from various ranges in the Yoo reference, in order to achieve a particular result. Applicants respectfully submit that the use of Applicants' disclosure in this manner, if the Examiner persists, is a clear case of impermissible hindsight reconstruction of a limitation not taught or reasonably suggested in any of the references.

I. (h) Mahadev et al (WO 92/20621) (hereafter "Mahadev")

Mahadev discloses a process for the removal of hydrogen sulfide and other sulfur compounds from sour natural gas and other fluid streams, and the conversion of the sulfur therein to elemental sulfur (page 1, lines 9-19). The Mahadev process is a two-step process involving the absorption of sulphur compounds from a fluid stream and then the subsequent decomposition of such compounds into elemental sulfur. (See page 3, line 16-20). This is a significantly different process from the process in Frame. The Mahadev catalyst is also significantly different from the catalyst system employed by Frame. The Mahadev catalyst is an alkali metal sulphide and sulphide or selenide of metal having polyvalent and/or amphoteric character on a microporous support. See e.g., Abstract; page 3, lines 28-31; claim 7. This catalyst is not even remotely similar to the two-component metal phthalocyanine catalyst system employed by Frame.

While Mahadev discloses a feed stream of natural gas containing up to 10 wt% hydrogen sulfide, and that the adsorptive capacity of the catalyst remains unchanged for feeds with less than 10 wt% hydrogen sulfide, as stated in the paragraph bridging pages 4 and 5 of the subject Office action, this would not make it obvious to one of ordinary skill in the art to modify the process of Frame to include a natural gas stream containing up to 10 wt% hydrogen sulfide "in order to preserve the adsorptive capacity of the catalyst" as contended on page 5 of the subject Office action. The two-component metal phthalocyanine catalyst system employed by Frame is an oxidation catalyst that operates in a medium having a pH of from 8 to 14. It does not operate by adsorption. Therefore, it would not be obvious to modify the process of Frame, which uses a

two-component metal phthalocyanine catalyst system, to oxidize up to 10 wt% hydrogen sulfide in natural gas “in order to preserve the adsorptive capacity of the catalyst”.

However, even assuming *arguendo* that it would be obvious to modify the process in Frame to treat gases containing high concentrations of hydrogen sulfide, this still would not result in the presently claimed process, since Frame only oxidizes hydrogen sulfide to elemental sulfur; not to sulfur dioxide as specified in the present claims. (See discussion in Section I.(e) above.)

With respect to claim 20, the Examiner cites Mahadev for its disclosure of a flue gas having a concentration of sulfur dioxide in the range of 1000 ppm to 2000 ppm. Applicants do not understand the relevance of this latter disclosure to claim 20, since claim 20 is dependent on claim 1 wherein the feedstock is specified to be a hydrocarbonaceous feedstock. Claim 20 further specifies the feedstock is a liquid hydrocarbonaceous feedstock containing at the most 1000 ppmv sulfur. Flue gas is obviously a gas, not a liquid as required by claim 20. In addition flue gas is not a hydrocarbonaceous feedstock as also required by claim 20.

Beyond the disclosure that natural gas can have a hydrogen sulfide concentration of up to 10 %, which Applicant acknowledges, Mahadev appears to have little relevance to the presently claimed selective oxidation process. Mahadev does not teach or reasonably suggest a catalyst similar to that employed in Applicants’ selective oxidation process, does not teach or reasonably suggest a feed mixture of a hydrocarbonaceous feedstock and a molecular-oxygen containing gas having an oxygen-to-carbon ratio of below 0.15, which is important to achieving selective oxidation of sulfur compounds with no or minimal oxidation of hydrocarbon compounds.

I. (i) Mackrodt et al (US 5,137,862) (hereafter “Mackrodt”)

Mackrodt discloses an oxidation process comprising reacting a feedstock with an oxygen-containing gas in the presence of an oxidic catalyst under conditions such that the catalyst attains a temperature of at least 1000 °C, wherein the catalyst is essentially free from elements, or compounds thereof, of Group VIII of the periodic table (col. 3, lines 17-23).

While Mackrodt does teach that yttria may be incorporated into zirconia supports as a means as stabilizing zirconia against phase changes, Mackrodt also teaches that the catalyst employed in the disclosed oxidation process must be essentially free from Group VIII metals, and that the oxidation process should be conducted under conditions that the catalyst attains a

temperature of at least 1,000 °C. Thus, Mackrodt, taken as a whole, teaches away from Applicants' process in which a Group VIII noble metal is employed as the essential catalytic component, and which process is conducted at temperatures below 500 °C.

It is also noted that the processes in which Mackrodt teaches its catalysts can be used are basically partial oxidation or catalytic combustion processes in which gaseous hydrocarbons feedstock is oxidized (col. 7, lines 5—30). This is in marked contrast to Applicants' process in which sulfur compounds are selectively oxidized to sulfur dioxide with no or minimal oxidation of hydrocarbons. This important feature of Applicants' process is expressly recited in the amended claims. Since Mackrodt is interested in maximizing combustion or oxidation of the hydrocarbon feedstock, the oxygen-to-carbon ratios in Mackrodt will be much higher than the below 0.015 ratio specified in the present claims. Therefore, Mackrodt adds nothing to overcome the deficiency of the primary Frame reference in failing to teach the oxygen-to-carbon ratios recited in the present claims.

I. (j) Evidence to Establish the Criticality of the Group VIII Noble Metal Concentration in the Present Catalyst Compositions is Not Required in the Present Circumstances.

On page 8 of the subject Office action, the examiner takes the position that the metals concentration range recited in the claims does not support the patentability of the claimed subject matter, since MPEP § 2144.06 requires evidence of the criticality of a claimed concentration range in order to support patentability. The MPEP section cited and relied upon by the Examiner to support this proposition is not properly applicable in the instant case. The MPEP section addresses situations involving optimization of ranges within known prior art ranges that may be determined through routine experimentation. This, however, is not the situation with the instant claims, which are directed to a process for the selective oxidation of sulphur in hydrocarbon feedstock by the use of a specifically defined catalyst composition that has a significantly different composition than those used in the prior art for this purpose. None of the cited references disclose concentration ranges for catalysts which selectively oxidize various sulfur compounds to sulfur dioxide, with no or minimal oxidation of non-sulfur containing hydrocarbonaceous compounds. Therefore, the Examiner's objection regarding the criticality of the recited metals concentration range is not applicable to the present circumstances.

II. The Rejection of Claims 46, 47, 49, 50, 70-74, and 80-84 under 35 U.S.C. §103(a) as Being Unpatentable over Frame (US 3,978,137) in view of Yoo (US 3,945,914), Mahadev (WO 92/20621), and Madgavkar (US 4,382,912), is Respectfully Traversed.

II. (a) The Catalyst in Frame Does Not Meet the “Consisting Essentially of” Limitation in the Present Claims

In rejecting claims 46, 47, 49, 50, 70-74, and 80-84 the Examiner states on page 6 of the subject Office action that Frame discloses a process using a catalyst “comprising” platinum, rhodium or iridium on a zirconia support. The present claims require a catalyst that “consists essentially of” a catalytically active group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof. As discussed in Section I. (b), above, Frame uses a two component catalyst system comprising a Group VIII metal phthalocyanine and a Group VIIB metal phthalocyanine as an essential component. Therefore, Frame does not meet the “consisting essentially of” limitation in the present claims.

As discussed in Section I. (c), above, the “consisting essentially of” limitation cannot appropriately be construed as “comprising”, in that novel and basic characteristics of the present process are disclosed in the present specification, and those novel and basic characteristics would be materially affected by introducing a Group VIIB metal phthalocyanine, which is a required component in the two component catalyst system of Frame.

II. (b) Neither Frame Nor Yoo Disclose a Gaseous Feed Mixture of a Hydrocarbonaceous Feedstock and a Molecular-Oxygen Containing Gas with an Oxygen-to-Carbon Ratio Below 0.15.

In rejecting claims 46, 47, 49, 50, 70-74, and 80-84 the Examiner acknowledges that Frame doesn’t disclose an oxygen-to-carbon ratio of below 0.10, but on page 7 of the subject Office action, contends that Yoo discloses a feed mixture having an oxygen-carbon ratio of 0.005 based on the Examiner’s calculations. As discussed in Section I.(g), above, the 0.005 ratio calculated by the Examiner is not reflective of the overall teachings of Yoo, is based in part on an incorrect assumption, and also involves impermissible hindsight reasoning.

II. (c) Madgavkar et al (US 4,382,9012) (hereafter “Madgavkar”)

Madgavkar discloses a process for purifying a hydrogen sulfide-containing carbon dioxide stream by selective oxidation of the hydrogen sulfide to sulfur dioxide without

concomitantly causing the reaction of carbon dioxide to form impurities such as carbonyl sulfide and carbon disulfide and undesirable hydrocarbon reaction products (abstract and col. 1, line 66 to col. 2, line 5). The resulting sulfur-containing carbon dioxide gas stream is then treated to remove sulfur dioxide so as to recover a sulfur free carbon dioxide stream, which can be injected into a petroleum formation for improving oil recovery (col. 2, lines 15-20). The catalyst employed by Madgavkar is an iron catalyst, preferably Fe_2O_3 , supported on an inert rigid porous refractory ceramic honeycomb support (col. 3, lines 37-40). Thus, the catalyst employed by Madgavkar is totally unlike the Group VIII noble metal catalyst employed in the present selective oxidation process. The feedstream treated in Madgavkar, a hydrogen sulfide-containing carbon dioxide gas stream, is also unlike the sulfur containing hydrocarbonaceous feedstock treated in the present selective oxidation process.

II. (d) Neither Mahadev or Madgavkar Overcome the Deficiencies of Frame and Yoo Discussed in Sections II. (a) and II. (b) above Regarding the Catalyst and the Oxygen-to-Carbon Ratios Employed in the Presently Claimed Process.

Neither Mahadev nor Madgavkar disclose a catalyst that consists essentially of a catalytically active group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof. As discussed in Section I. (h), above, Mahadev uses an alkali metal sulphide and sulphide or selenide of metal(s) having polyvalent and/or amphoteric character on a microporous support to absorb sulfur compounds. As discussed in Section II. (c), above, Madgavkar employs an iron catalyst, preferably Fe_2O_3 , supported on a ceramic honeycomb support, to oxidize hydrogen sulfide in a hydrogen sulfide-containing carbon dioxide gas stream (Madgavkar, abstract and col. 2, lines 5-14). Thus, neither Mahadev nor Madgavkar cure the deficiency of Frame in not teaching a catalyst that consists essentially of a catalytically active Group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof, which is a limitation in each of claims 46, 47, 49, 50, 70-74, and 80-84.

In addition, neither Mahadev nor Madgavkar teaches or reasonably suggests a feed mixture of a hydrocarbonaceous feedstock and a molecular-oxygen containing gas having an oxygen-to-carbon ratio of below 0.15. Mahadev removes sulphur compounds such as hydrogen sulfide and sulfur oxides from fluid streams, such as flue gas, by absorption. Hence, there is no feed mixture of a hydrocarbonaceous feedstock and a molecular-oxygen containing gas in Mahadev. Consequently, there is no teaching in Mahadev regarding an oxygen-to-carbon ratio of such a feed gas mixture. Oxygen is not introduced in Mahadev until the second step (the

regeneration step), in which the sulfur compounds absorbed in the first step are decomposed to elemental sulfur.

The process disclosed in Madgavkar involves removing hydrogen sulfide from a hydrogen-sulfide-containing carbon dioxide gas stream. Hence, Madgavkar does not teach a feed mixture of a hydrocarbonaceous feedstock and a molecular-oxygen containing gas having an oxygen-to-carbon ratio below 0.015. (Carbon dioxide is not a hydrocarbonaceous feedstock.)

In summary, neither Frame, Yoo, Mahadev nor Madgavkar teach or reasonably suggest a selective oxidation catalyst that “consists essentially of a catalytically active group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof”, or a “feed mixture of a hydrocarbonaceous feedstock and a molecular-oxygen containing gas having an oxygen-to-carbon ratio of below 0.15”. Therefore, claims 46, 47, 49, 50, 70-74, and 80-84 are patentable over the cited combination of references.

III. The Rejection of Claims 1, 2, 9, 11-21 and 24 under 35 U.S.C. §103(a) as Being Unpatentable over De Jong (US 5,720,901) in view of Mackrodt (US 5,137,862), is Respectfully Traversed.

III. (a) De Jong et al (US 5,720,901) (hereafter “De Jong”)

The process taught by De Jong relates to the catalytic partial oxidation of hydrocarbons to what is known in the art as synthesis gas, i.e., carbon monoxide and hydrogen (col. 1, lines 5-20). This is a significantly different process than the process recited in the present claims, which is selective oxidation process in which sulfur compounds are oxidized to sulfur dioxide, with no or minimal oxidation of hydrocarbon compounds. Thus, the present selective oxidation process is a very different from the catalytic partial oxidation in De Jong wherein hydrocarbons are intentionally oxidized to form a carbon monoxide and hydrogen synthesis gas.

While the catalyst disclosed by De Jong as being useful for catalytic partial oxidation is similar to the catalyst employed in Applicants’ selective oxidation process, Applicants submit it would not be obvious to one of ordinary skill in the art to employ the catalyst disclosed in De Jong for selective oxidation, since De Jong teaches the catalyst will oxidize hydrocarbons as well as any sulfur compounds. As discussed above, De Jong intentionally oxidizes the hydrocarbon feed in order to produce synthesis gas. There is nothing in De Jong which suggests the disclosed catalysts could be used in a selective oxidation process in which the objective was not to oxidize hydrocarbons. If anything, De Jong teaches away from the use of the disclosed catalyst in a

selective oxidation process where there is no or minimal oxidation of hydrocarbons, such as that recited in the present claims. The present invention is in part based on the surprising discovery that catalysts which had been used to oxidize hydrocarbons, could be used to selectively oxidize sulfur compounds, with little or no oxidation of hydrocarbons, by operating at temperatures and oxygen-to-carbon ratios within the limits specified in the present claims.

Thus, there are at least three significant differences between the process disclosed in De Jong and Applicants' process. These differences include the products produced by the respective processes, the temperature employed in the respective processes, and the oxygen-to-carbon ratio of the feed mixtures to the respective processes.

Regarding the products produced by the respective processes, De Jong's catalytic partial oxidation process oxidizes the hydrocarbon feed to produce a synthesis gas product, i.e., carbon monoxide and hydrogen. In marked contrast, Applicants' catalytic selective oxidation process does not oxidize the hydrocarbon feed, but instead produces a hydrocarbon product having substantially the same composition as the hydrocarbons in the original feed stream. Only the sulfur compounds are oxidized to sulfur dioxide.

The second significant difference between the respective processes is the temperatures at which they are operated. Applicant's selective oxidation process is operated at a temperature of at the most 500 °C. The partial oxidation process disclosed in De Jong is operated at a temperature of at least 950 °C, preferably 950 °C to 1300 °C (De Jong, col. 5, lines 49-51)

The third significant difference between the respective processes is the oxygen-to-carbon ratio of the hydrocarbon/oxygen feed mixture. Applicants are able to achieve selective oxidation of the sulfur compounds, without oxidizing hydrocarbons, by using an oxygen-to-carbon ratio of below 0.15. In marked contrast, in order to oxidize the hydrocarbon feedstock to produce carbon monoxide and hydrogen, De Jong employs a much higher oxygen-to-carbon ratio of 0.3 to 0.8, more preferably from 0.45 to 0.75 (De Jong, col. 4, lines 52-54).

On page 9, and again on page 13, of the subject Office action the Examiner finds the Applicants' temperature limitation and oxygen-to-carbon ratio limitation of no patentable consequence because De Jong discloses in col. 5, line 44, that the process may be operated at any suitable temperature, and wherein the feed may comprise the hydrocarbon feedstock and oxygen in any amount sufficient to give a suitable oxygen-to-carbon ratio (col. 4, lines 50-52).

In response it is pointed out that the overall objective of De Jong is to produce synthesis gas, which requires oxidizing the hydrocarbon feedstock. De Jong expressly teaches in col. 5, lines 45-54, that elevated temperatures are required in order to achieve the level of conversion required for commercial scale operation, and that this requires a temperature of at least 950 °C, preferably 950 to 1300 °C.

Regarding the oxygen-to-carbon ratio, De Jong goes on to teach in col. 4, lines 53-59, that the oxygen-to-carbon ratios should preferably be in the range of from 0.3 to 0.8, more preferably 0.45 to 0.70. These higher ratios are necessary for De Jong to accomplish the objective of their invention, which is to oxidize the hydrocarbon feedstock to produce synthesis gas. These ranges, which are expressly taught by De Jong are far greater than the below 0.15 oxygen-to-carbon ratio recited in the present claims.

Applicants respectfully submit that it would be unreasonable for the Examiner to ignore the express teachings in De Jong regarding the use of elevated temperatures and high oxygen-to-carbon ratios, and take the position that a general teaching of “*any*” temperature and “*any*” oxygen-to-carbon ratio suggests employing temperatures below 500 °C and oxygen-to-carbon ratios of below 0.15. The unreasonableness of such a position is apparent when one considers that temperatures of below 500 °C and oxygen-to-carbon ratios below 0.15 have been found by Applicants to result in selective oxidation of sulfur compounds with little or no oxidation of hydrocarbons. De Jong, on the other hand, is interested in maximizing oxidation of the hydrocarbonaceous feedstock in order to produce as much synthesis gas as possible. Thus, a more reasonable interpretation of the teaching of “*any*” temperature and “*any*” oxygen-to-carbon ratio in De Jong, is any temperature and any oxygen-to-carbon ratio that would result in the oxidation of the hydrocarbon feedstock to produce synthesis gas, which is the objective of the De Jong process. De Jong cannot reasonably be said to teach or reasonably suggest the temperature limitation and the oxygen-to-carbon limitation recited in the present claims, which do not result in the oxidation of the hydrocarbonaceous feedstock.

III. (b) Mackrodt Does Not Overcome the Deficiencies in De Jong

As discussed in Section I. (i), above, Mackrodt discloses an oxidation process comprising reacting a feedstock with an oxygen-containing gas in the presence of an oxidic catalyst under conditions such that the catalyst attains a temperature of at least 1000 °C, wherein the catalyst is

essentially free from elements, or compounds thereof, of Group VIII of the periodic table (col. 3, lines 17-23). The process in which the catalysts disclosed in Mackrodt can be used are basically partial oxidation or catalytic combustion processes in which gaseous hydrocarbons feedstock is oxidized (col. 7, lines 5—30). This is in marked contrast to Applicants' process in which sulfur compounds are selectively oxidized to sulfur dioxide with no or minimal combustion or oxidation of hydrocarbons. Since Mackrodt, like De Jong, is interested in maximizing combustion or oxidation of the hydrocarbon feedstock, Mackrodt employs elevated temperatures, e.g., at least 1000°C, and likely also employs oxygen-to-carbon ratios much higher than the below 0.15 ratio specified in the present claims. Therefore, Mackrodt adds nothing to overcome the deficiency of the primary De Jong reference in not teaching or suggesting the temperature or oxygen-to-carbon ratio limitations recited in the present claims.

IV. The Rejection of Claims 25, 26, 30, and 33-34 under 35 U.S.C. §103(a) as Being Unpatentable over De Jong (US 5,720,901) in view of Mackrodt (US 5,137,862) and D'Souza (US 4,233,276), is Respectfully Traversed.

IV. (a) Neither De Jong nor Mackrodt Teach or Suggest the Temperature or Oxygen-to-Carbon Ratio Limitations Specified in Claims 25, 26, 30, and 33-34

As discussed in Sections III. (a) and III. (b) above, neither De Jong nor Mackrodt teach or reasonably suggest a process in which sulfur compounds in a hydrocarbonaceous feedstock are selectively oxidized to sulfur dioxide with no or minimal oxidation of the hydrocarbon feedstock employing a temperature of at the most 500 °C and an a feed mixture having a oxygen-to-carbon ratio of below 0.15 or less. De Jong and Mackrodt employ elevated temperatures and relatively high oxygen-to-carbon ratios in order to intentionally oxidize or combust the hydrocarbon feedstock.

IV. (b) D'Souza et al (US 4,233,276) (hereafter "D'Souza") Does Not Overcome the Deficiencies in De Jong and Mackrodt

D'Souza discloses a process for removing oxidizable sulfur compounds from waste streams, preferably from a Claus plant, by oxidizing the waste gas with molecular oxygen to convert the oxidizable sulfur compounds and free sulfur to sulfur dioxide or sulfur trioxide. The sulfur dioxide and sulfur trioxide are subsequently removed using a metal oxide adsorbent. The

metal oxide absorbent is subsequently regenerated with a hydrocarbon in the presence of a hydrocracking catalyst (D'Souza, col. 3, line 66 to col.4, line 10).

D'Souza is apparently cited for its teaching that sulfur dioxides and trioxides can be removed from an oxidized stream using copper oxide or barium oxide, which Applicants acknowledge. However, Applicants are not relying on the removal of sulfur dioxide using a metal oxide adsorbent for the patentability of claims 25, 26, 30 and 33-34. Instead, Applicants are relying on the fact that neither D'Souza (nor De Jong nor Mackrodt) teach or reasonably suggest a selective oxidation process operated at a temperature of at the most 500 °C, using a feed mixture having an oxygen-to-carbon ratio of below 0.15, where sulfur compounds are oxidized to sulfur dioxide with minimal or no oxidation of hydrocarbons. There is no teaching or suggestion in D'Souza that the waste gas, such as a Claus plant tail gas, oxidized in step (a) is a hydrocarbonaceous feedstock, or that the sulfur compounds are selectively oxidized, or that the oxidizing step (step (a)) is performed at a temperature of at the most 500 °C, or that the feed mixture used in the oxidizing step had an oxygen-to-carbon ratio below 0.15. It is noted that the temperatures disclosed in col. 4, lines 28-43, are for steps (b) and (c), not step (a) which is the oxidizing step.

Therefore, D'Souza, while disclosing the use of copper and barium oxide adsorbents for removing sulfur dioxide, does not cure the basic deficiencies of De Jong and Mackrodt in failing to teach or reasonably suggest a selective oxidation process, operated at a temperature of at the most 500 °C, or the use of a feed mixture having an oxygen-to-carbon ratio of below 0.15.

Accordingly, claims 25, 26, 30 and 33-34 are patentable over the cited combination of references.

V. The Rejection of Claims 45, 48, 65-69, and 75-79 under 35 U.S.C. §103(a) as Being Unpatentable over De Jong (US 5,720,901) in view of Mackrodt (US 5,137,862) and Wachs (US 7,374,666), is Respectfully Traversed.

V. (a) Neither De Jong nor Mackrodt Teach or Suggest the Temperature or Oxygen-to-Carbon Ratios Specified in Claims 45, 48, 65-69, and 75-79

As discussed in Sections III. (a) and III. (b), above, neither De Jong nor Mackrodt teach or reasonably suggest a process in which sulfur compounds in a hydrocarbonaceous feedstock are selectively oxidized to sulfur dioxide with no or minimal oxidation of the hydrocarbon feedstock employing a temperature of at the most 500 °C and an a feed mixture having a oxygen-

to-carbon ratio of below 0.015 or less. De Jong and Mackrodt teach using elevated temperatures and relatively high oxygen-to-carbon ratios in order to intentionally oxidize or combust the hydrocarbon feedstock.

V. (b) Wachs (US 7,374,666) (hereafter “Wachs”) Does Not Overcome the Deficiencies of De Jong and Mackrodt Regarding the Temperature and Oxygen-to-Carbon Ratio

Wachs discloses a process for desulfurizing a hydrocarbon stream containing heterocyclic sulfur compounds which comprises contacting the heterocyclic sulfur compounds in gas phase with a supported metal oxide catalyst or a bulk metal oxide catalyst to convert at least part of the heterocyclic sulfur compounds to oxygenated products (Abstract, col. 5, lines 33-40). The oxygenated products may include maleic anhydride, phenol, benzyl aldehyde and benzoic acid and like (col. 15, lines 30-34). The metal oxide catalyst can be based on various metals including titanium, zirconium, molybdenum, rhenium, vanadium, chromium, etc. (col. 5, lines 40-56). Suitable supports for the metal oxide catalysts include titania, silica, zirconia, alumina, ceria, magnesia, etc. (col. 5, lines 48-56). There is no disclosure in Wachs of a Group VIII noble metal catalyst of the type employed in present process.

Wachs is apparently cited for its teaching that cerium and zirconium are useful adjuvants that may be added to an oxidation catalyst. There is no disclosure in Wachs of incorporating zirconium and/or cerium into a selective oxidation catalyst consisting essentially of a Group VIII noble metal. Moreover, there is also no disclosure in Wachs as to the temperature at which oxidation process is conducted to produce the oxygenated products, or the oxygen-to-carbon ratio of the feed mixture. Therefore, while disclosing zirconium and ceria can be incorporated into an oxidation catalyst (albeit, a non-Group VIII metal oxidation catalyst), Wachs does not teach or suggest the temperature and the oxygen-to-carbon limitations recited in the present claims. Therefore, Wachs does not overcome the deficiencies of De Jong and Mackrodt in this regard.

VI. The Rejection of Claims 51 and 85-89 under 35 U.S.C. §103(a) as Being Unpatentable over De Jong (US 5,720,901) in view of Mackrodt (US 5,137,862), D’Souza (US 4,233,276), and Wachs (US 7,374,666), is Respectfully Traversed.

VI. (a) Neither De Jong nor Mackrodt Teach or Suggest the Temperature Limitation or the Oxygen-to-Carbon Ratio Specified in Claims 51 and 85-89

As discussed in Sections III. (a) and III. (b), above, neither De Jong nor Mackrodt teach or reasonably suggest a process in which sulfur compounds in a hydrocarbonaceous feedstock are selectively oxidized to sulfur dioxide with no or minimal oxidation of the hydrocarbon feedstock employing a temperature of at the most 500 °C and an a feed mixture having a oxygen-to-carbon ratio of below 0.15. De Jong and Mackrodt teach using elevated temperatures and relatively high oxygen-to-carbon ratios in order to intentionally oxidize or combust the hydrocarbon feedstock.

VI. (b) Neither D'Souza nor Wachs Teach or Suggest the Temperature Limitation or the Oxygen-to-Carbon Ratio Specified in Claims 51 and 85-89

As discussed in Sections IV. (b) and V. (b), above, neither D'Souza nor Wachs teach or reasonably suggest a process in which sulfur compounds in a hydrocarbonaceous feedstock are selectively oxidized to sulfur dioxide with no or minimal oxidation of the hydrocarbon feedstock employing a temperature of at the most 500 °C and an a feed mixture having a oxygen-to-carbon ratio of below 0.15.

Accordingly, claims 51 and 85-89 are patentable over the cited combination of references.

VII. The Rejection of Claims 46, 47, 49, 50, 70-74, and 80-84 under 35 U.S.C. §103(a) as Being Unpatentable over De Jong (US 5,720,901) in view of Madgavkar (US 4,382,912), is Respectfully Traversed

VII. (a) Neither De Jong nor Madgavkar Teach or Suggest the Temperature or Oxygen-to-Carbon Ratios Specified in Claims 46, 47, 49, 50, 70-74, and 80-84

As discussed in Sections III. (a) and II. (c) and II. (d), above, neither De Jong nor Madgavkar teach or reasonably suggest a process in which sulfur compounds in a hydrocarbonaceous feedstock are selectively oxidized to sulfur dioxide with no or minimal oxidation of the hydrocarbon feedstock employing a temperature of at the most 500 °C and a feed mixture of a hydrocarbonaceous feedstock and a molecular oxygen containing gas having a oxygen-to-carbon ratio of below 0.15. The oxidation process in De Jong is not a selective oxidation process. The hydrocarbonaceous feedstock in De Jong is intentionally oxidized at

elevated temperatures, e.g. 950 to 1300 °C, and relatively high oxygen-to-oxygen ratios, e.g., 0.3 to 0.8, to produce synthesis gas. These temperatures and oxygen-to-carbon ratios are well outside of the temperature and oxygen-to-carbon ratio specified in the present claims.

The feedstock in Madgavkar is a hydrogen sulfide-containing carbon dioxide stream. Therefore, Madgavkar does not meet the limitation in the present claims of a feed mixture of a hydrocarbonaceous feedstock and a molecular-oxygen containing gas having an oxygen-to-carbon ratio of below 0.15.

Accordingly, claims 46, 47, 49, 50, 70-74, and 80-84 are patentable over the cited combination of references.

VIII. The Rejection of Claims 52, 53, and 90-94 under 35 U.S.C. §103(a) as Being Unpatentable over De Jong (US 5,720,901) in view of Madgavkar (US 4,382,912) and D’Souza (US 4,233,276), is Respectfully Traversed

VIII. (a) Neither De Jong nor Madgavkar Teach or Suggest the Temperature or Oxygen-to-Carbon Ratios Specified in Claims 52, 53, and 90-94.

As discussed in Sections III. (a) and II. (c) and II. (d), above, neither De Jong nor Madgavkar teach or reasonably suggest a process in which sulfur compounds in a hydrocarbonaceous feedstock are selectively oxidized to sulfur dioxide with no or minimal oxidation of the hydrocarbon feedstock employing a temperature of at the most 500 °C and a feed mixture of a hydrocarbonaceous feedstock and a molecular oxygen containing gas having a oxygen-to-carbon ratio of below 0.15 or less. The oxidation process in De Jong is not a selective oxidation process. The hydrocarbonaceous feedstock in De Jong is intentionally oxidized at elevated temperatures, e.g. 950 to 1300 °C, and relatively high oxygen-to-oxygen ratios, e.g., 0.3 to 0.8, to produce synthesis gas. These temperatures and oxygen-to-carbon ratios are well outside of the temperature and oxygen-to-carbon ratio specified in the present claims.

The feedstock in Madgavkar is a hydrogen sulfide-containing carbon dioxide stream. Therefore, Madgavkar does not meet the limitation in the present claims of a feed mixture of a hydrocarbonaceous feedstock and a molecular-oxygen containing gas having an oxygen-to-carbon ratio of below 0.15.

VIII. (b) D'Souza Does Not Overcome the Deficiencies in De Jong and Madgavkar

As discussed in Section IV. (b), above, D'Souza discloses a process for removing oxidizable sulfur compounds from waste streams, preferably from a Claus plant, by oxidizing the waste gas with molecular oxygen to convert the oxidizable sulfur compounds and free sulfur to sulfur dioxide or sulfur trioxide. The sulfur dioxide and sulfur trioxide are subsequently removed using a metal oxide adsorbent. D'Souza apparently is cited for its teaching of adsorbents for removing sulfur containing components in an oxidized stream. D'Souza does not teach or suggest a process in which sulfur compounds in a hydrocarbonaceous feedstock are selectively oxidized to sulfur dioxide with no or minimal oxidation of the hydrocarbon feedstock employing a temperature of at the most 500 °C and a feed mixture of a hydrocarbonaceous feedstock and a molecular oxygen containing gas having a oxygen-to-carbon ratio of below 0.15. Thus, D'Souza does not overcome the deficiencies of De Jong and Madgavkar discussed above.

Accordingly, claims 52, 53, and 90-94 are patentable over the cited combination of references.

Conclusion

For all the above reasons and in view of the amendments, it is respectfully submitted that claims 1-2, 9, 11-21, 24-26, 30, and 33-94 are patentable over the cited references. Accordingly, their early allowance is respectfully requested.

Respectfully submitted,

CAROLUS M. A. M. MESTERS and
RONALD J. SCHOONEBEEK

By Charles W. Stewart/
Attorney, Charles W. Stewart and
Leonard P. Miller
Registration No. 34,023 and 26,004
(713) 241-0360

P.O. Box 2463
Houston, Texas 77252-2463